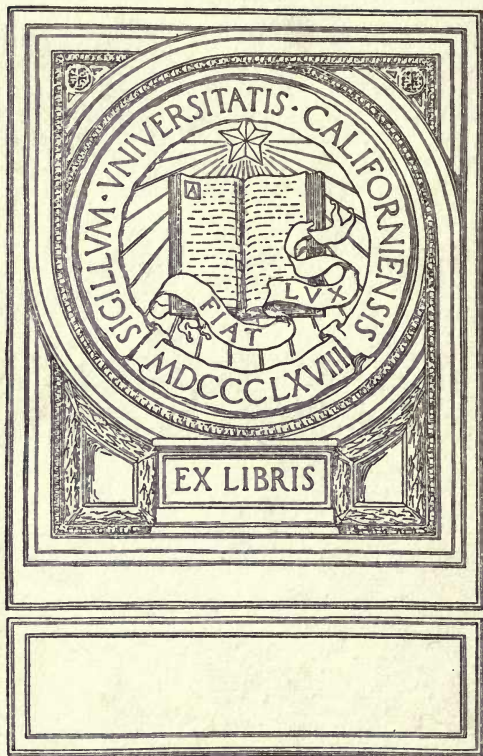


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*A Comparison & a Contrast*

INAUGURAL LECTURE DELIVERED AT  
UNIVERSITY COLLEGE, LONDON  
ON 12 MAY, 1920

BY

CHARLES SINGER

LECTURER ON THE HISTORY OF MEDICINE

*Price One Shilling and Sixpence*

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# GREEK SCIENCE AND MODERN SCIENCE

## A COMPARISON AND A CONTRAST

ALTHOUGH the philosophical historian has flourished in England as perhaps nowhere else in the world, the approach to Science through History has yet been much neglected in this country. The subject was well opened, it is true, by the great Master of Trinity to whom the Cambridge scientific school owes so much, and he was ably seconded by one of the most brilliant and original men who have adorned this College. But it is nigh three generations since Whewell and De Morgan wrote the masterpieces that have carried their names to our day, and no historian of Science has since appeared among us to rival Tannery and Schiaparelli in philosophic grasp, or Boncompagni, Cantor and Duhem in learning. In the kindred department of the History of Medicine our record has, if anything, been even worse. With the single exception of Francis Adams, who belonged to the same generation as Whewell and De Morgan, we have had no medical historian whose achievements have been of the front rank, no one to place by the side of Sprengel, Haeser, and Pagel in Germany; of De Renzi in Italy; and of Daremberg, Malgaigne, and Nicaise in France. Left without academic recognition, the History of Science and the History of Medicine have indeed earned in this country a reputation for triviality and inconsequence by their

## 4 GREEK SCIENCE AND

frequent alliance either with a superficial type of biography which seems interested in every item of a scientific man's life save his mental processes, or with an antiquarianism, rightly termed *curious*, which concerns itself with the quaint and exceptional rather than with the actual development of scientific thought.

It is appropriate and it is natural that the College where Augustus de Morgan spent the whole of his active life, and on which he lavished all his great powers of heart and head, should be the first institution in England to make any serious endeavour to remedy this defect. Under the stimulus and on the initiative of my friend and colleague Dr. Wolf, a beginning has been made towards a systematic course of lectures in the History of Science and of Scientific Ideas. May I say, in all humility, that I look forward to carrying on some fraction of De Morgan's work and to aiding Dr. Wolf and his collaborators in placing before students an outline sketch of the long and intricate story which begins with the confused ideas of the relation of cause and effect inherent in the mind of every savage, and culminates in the great store of natural knowledge that has become the peculiar heritage of our age.

A new need for the historical treatment of this material has arisen. We must frankly recognize that the whole scheme of education is undergoing rapid transformation. We need not discuss these changes, but it is sufficiently obvious that the staple education of the near future will be increasingly vocational. It seems certain that the discipline of Science must largely replace the training in the older Humanities. It is a function of education, perhaps its main function, to provide each generation with a working theory of how it came to be what it is. Such a working theory was, in fact, success-



fully provided by the old Humanities from the period of the Revival of Learning until a generation or two ago. The basic doctrine of these older Humanities was that outside the domain of religion all we have and all we are come to us from the civilizations of Greece and Rome. But it is a theory of life which has become untenable in the form held by our grandfathers; the revelations of archaeology, the discoveries of anthropology and recent developments of psychology are all against it. The Classics, indeed, still are and always will be pursued with ardour and admiration, yet they can never be regarded in quite the old way. These literatures are now studied, and can only be studied, scientifically and analytically as part of our heritage from the past; they are for us the best explored and best known, the sanest and most complete, the most worthy and in many ways the most lovable type that antiquity has to offer. But they can no longer take the place of antiquity itself, still less do they cover the wide range of human aspiration.

✓ The Classics in the old sense as the staple of education were thus perhaps inevitably doomed. But Science, as such—I use the word for the moment in its restricted meaning—though it may *displace* the Humanities, cannot *replace* them, for it cannot provide us with any clear record of how we have developed mentally. For this we must turn to History, but History not in the narrow sense in which that word has so often been used as equivalent to Political History, nor even Sociological History. It is the history of mankind as a whole that we need, the history of civilization, the history of man's thoughts, of man's knowledge, of man's self.

For those whose education is mainly grounded in Science, and especially for those who are to follow Science as a career, the History of Science is thus in

itself surely an appropriate study. But there is, I think, another and more immediately practical ground on which we may plead for the introduction of History into the scientific curriculum. We are well accustomed to recognize that the store of acquired scientific knowledge is a general treasury from which all men draw, by which alone it has been possible for our material state to rise above that of the savage. Yet we seldom remind ourselves that the guardianship of this treasury, the heritage of all men, has always been in the hands of a very small band, and this has been so in all its wanderings. From the lands of the ancient East it passed to Greece, then having dwelt awhile among the Saracens it came to Italy, and it has at last reached the West. In all these countries and at all these periods the organic apparatus by which new knowledge has been created has been the work of a mere handful.

Surely the contemplation of the conditions under which these men worked and lived, the examination of their training and mental history, of their environment and manner of development, must be of value even in the practical everyday sense to those who would follow in their footsteps. And the other side of the picture is also not without its application. The study of those social and economic and philosophical conditions that *fail* to produce effective scientific fruit, or that yield only bizarre and deformed products, has also its lesson. Some idea of the Science of these retrograde periods must also be included in any course on the History of Science, and should form an integral part of any scientific education worthy of the name. The scientific student would thus be grounded in the elements of what we may call the Embryology, the Physiology and the Pathology of his special study.



But there is yet another aspect of the History of Science. Our scientific system of its nature claims an independence of all race, nationality, or creed. It is of all studies the most truly international. The scientific man may, better than most, claim with St. Paul that he is a citizen of no mean city, that he is the true citizen of the world. Nevertheless, in all countries and at all periods there has been a certain local and temporal stamp in the Science that has been produced. These differences, however, concern the processes and methods of Science rather than its results or aims. Now among the processes and methods of Modern Science there are, as it seems to me, certain new factors of an order that the world has not before seen; and though he must be sanguine indeed who believes that, of our nature and because we are who we are, the guardianship of the scientific treasury will always remain with us, yet these new factors give us some hope of a permanence in our scientific results of a character never before attained. It is the facts on which the hope of such permanence may be based that I propose to discuss to-day.

To bring these points in our scientific system into adequate relief we need some basis of comparison. I propose to use for this purpose the best defined scientific system of antiquity that is presented to the historian's view, I mean the scientific system of the Greeks.

\*✓ Greek Science may be said to take its origin among the Ionian colonies in the seventh century B.C. Whence did it derive? We may probably distinguish three roots: (1) the Mesopotamian, (2) the Egyptian, and (3) the Minoan; and our knowledge of these three sources is in the order named. From Mesopotamia the Ionian Greek derived his basic mathematical conceptions, together with much of his astronomical and cosmological system.



✓ Above all, he inherited from the valley of the Euphrates a whole mass of effective observations upon which, in the first instance, his scientific system was built. From Egypt he inherited chiefly mechanical devices ; some knowledge of drugs and certain elements in his method of reckoning time. Nor can we, despite the absence of direct evidence, afford to neglect the uniformity with which Greek tradition attributes the special development of geometry to the Egyptians. The Minoan inheritance, in the absence of a key to the script, is an entirely uncertain quantity, but it is very tempting to connect the serpent so frequently present in Minoan relics with the well-known chthonic and Aesculapian symbol. Even the very earliest Greek medical writings, some of which can be referred back to the seventh century B.C., presuppose long generations of research and of the careful record of observations. Now what we know of the Greeks of this period and of their state of civilization does not yield a picture of conditions under which such observations could easily be made and recorded. It seems more likely that this element also was an inheritance, and since we cannot suppose that any system of scientific medicine was derived from such neighbours of the Greeks as the Babylonians or Egyptians, we are thrown back on the Minoan civilization as a source.

✓ Whatever its sources may have been, however, Greek Science began its course along with or rather as an essential part of Greek philosophy in the Ionian cities of Asia Minor in the seventh century B.C. In the great social systems of the East there had long been accumulating great masses of observation, and upon them rough generalizations had been erected. These generalizations on which the Greeks so largely drew, appear to have

been an evolutionary product of what may be called the social consciousness rather than the definite fruit of individual minds. From all the civilizations of the ancient East, save from Greece alone, scarcely the name of a discoverer or an inventor has come down to us. It is characteristic of this pre-Greek material that it is a social, not an individual product.

Into this great anonymous Oriental heritage the philosophers of the Ionian cities were fortunate enough to enter. They come often under grave suspicion of concealing their debt to antiquity, and it is unfortunate that the more reliable accounts of the origin of Greek Science, such as the History of Mathematics by Eudemus, the pupil of Aristotle, are lost to us. But once the Greeks had inherited this scientific system they impressed it with their own individuality in their own self-centred way. Their self-centred character has often been remarked, and had indeed been observed by the Greeks themselves. They thought as individuals, not as a people; and the Science that they inherited from antiquity, from being anonymous became, in their hands, eponymous, a character which it has ever since retained. Science from their time to ours has always been the fruit of individual minds and not a product of the social consciousness.

But there is another point in which the Science of the Greeks divides them from the ancient East and unites them with us. It is their conviction of Order, their faith that Order reigns in Nature. This is their great and most vital contribution to scientific thought. Now it is very interesting to observe that this trust in the reign of law was with them a faith or intuition and in no sense the result of observation. The actual basis of observed fact on which the Ionian philosophy was founded was



of the flimsiest. Further, the Greeks, it would be easy to show, were on the whole a credulous people. Yet their earliest scientific works of which we have substantial remains are as free from that scepticism concerning the essential order of the Universe that we call superstition, as full of the idea of natural and discoverable law as any modern treatise on Physiology or Physics. Greek scientific works often blunder in observation or err in inference, they all too frequently accept facts at second hand or without verification, and it is their besetting sin that they constantly make sweeping generalizations on inadequate evidence. But their firm faith in order is that which marks off their view of the Universe from that of all other ancient and from all primitive peoples. It is a truly marvellous thing to contemplate how sincerely and how fervently, how constantly and under what a variety of character the Greeks expressed their vision of a wholly reasonable world, their *Theoria* which, according to the greatest of them all, literally makes man like God.

Theirs is a view that has justified itself in the centuries that have since passed. The Greek's knowledge of Nature was a very little thing placed by the side of the vast hoard that the centuries have brought to us. Yet the more we investigate our world and probe its mysteries, the further do we trace that order on which the Greek based his faith. It is not, of course, that the mystery becomes less, but it becomes more *circumferential*. As we make our clearing in this infinite forest, the space around us widens, the trees recede, and if the forest gets no smaller at least there smite less upon our ears those wild and uncouth forest notes, those

enchantments drear

Where more is meant than meets the ear.



It is this sense of the reign of law together with the personal character of scientific investigation that the Greeks have handed down to us. It is these things that unite us with them and separate our Science from that of the ancient East.

So far we have considered the resemblance of our Science to that of the Greeks. We may now turn to the elements which separate us from them. In considering these elements we must, for the moment, expressly exclude mathematical Science which, as we shall see, needs to be considered apart.

When the philosophers of Ionian Greece had at last entered on the heritage of antiquity, they began at once to engage on that continuous and active process of cosmic speculation that became the ancestor of the characteristic Greek Philosophy and through it of Greek Science. No people were ever more free from theological and social prejudices, and Greek thought developed without any of those trammels from which the modern system has but very slowly disengaged itself.

As time went on knowledge accumulated, and separate sciences were gradually differentiated from the philosophy from which they had sprung. The earliest departments to be thus separated were naturally those in which the idea of number could be invoked. Mathematics thus became the first science in point of time, and by the extent to which mathematical principles can be applied we must still often test the stage that any science has reached. In the course of centuries the sciences became separated more and more from the parent stock of philosophy, but it is peculiar to Greek scientific thought that it never loses its relationship and dependence on its parent. Whether we look to the earliest traces of the scientific spirit in the seventh

century B.C., when Pythagoras was working out his first formulated conceptions of the relation of number to form, or whether we look to the last vitally original works of Greek Science in the second century C.E., when Galen was giving to the world those ideas on anatomy and physiology which were to control medical thought for a millennium and a half, from end to end Greek Science betrays its relationship to Greek Philosophy. It is thus in keeping with the rest of the story that both Pythagoras and Galen were in intimate relation with philosophical sects.

No such ancestry can be ascribed to Modern Science, and herein we differ from the Greeks. The exponents of our modern scientific system have seldom sought to follow the Greek metaphysician in his attempts to pass the flaming ramparts of the world. Until lately it was the custom to regard the period of the Revival of Learning as identical with that of the Revival of Science, but the facts will not accommodate themselves to this view, and it may easily be shown that the roots of the scientific revival extend much further back in time than the Renaissance. But the history of the childhood of Modern Science has not been adequately written, nor are the facts yet in our hands for such work. Before it is possible much more research into sources is needed. It is some reflection on the humanistic education that has prevailed for four hundred years that while the records of ancient philosophy have been explored from end to end, we still await the material for any comprehensive statement of the developmental stages in the characteristic mode of thought of our own age. While scholars ransack the monasteries of the East or the dust-heaps of Egypt for such remains of Greek literature as may yet be recovered from the fragments of parchment



✓ or papyrus, the works of our first scientific thinker, Roger Bacon, lie here at hand, unedited, forgotten, neglected.

Yet despite this neglect, certain facts concerning the beginnings of Modern Science have been ascertained and are sure and firm. Firstly, Modern Science did not arise as an offspring of Philosophy, nor until it had gained some strength of its own did it form any alliance therewith. Formal Philosophy, unknown apart from Theology in the Middle Ages, played a subordinate part in the Revival of Letters, nor were the earlier Renaissance philosophers at all in line with scientific discovery. Secondly, the Revival of Science was not directly related to the revived knowledge of Greek. The Greek scholars of the Renaissance showed no more sympathy with scientific investigation than was exhibited by their colleagues the philosophers, and the early humanistic period was, on the whole, backward and even retrogressive in its scientific conceptions.

Greek Science, we have seen, was from its birth inextricably interwoven with Philosophy. Modern Science has in fact passed through its earlier stages of development without this relationship and in a very different environment from that of Greek Science. Limited on every side, forbidden the field of free speculation, cut off from the departments held to be the peculiar domain of the mediaeval ecclesiastic, lawyer or statesman, Science in its early stages applied itself almost exclusively to the solution of so-called *practical* problems. ✓ The mariner availed himself of the compass without holding any theory of terrestrial magnetism. He boldly put to sea with charts to aid him that had been prepared by mapmakers as innocent as he was himself of the Ptolemaic or of any other system of spherical projection.



Free speculation was as yet an impossibility for the age, and the rulers of the age were in union against it. But minds closed to argument may be open to evidence. \* Prince and Prelate were ready enough to curtail the activities of one who held unsettling views on the ideal nature of the State or the theoretical form of the World. ✓ Yet these potentates were perfectly willing, nay were eager, to experiment on their enemies with the newly discovered combination of carbon, sulphur, and nitre known as gunpowder, or to aid their failing vision by the contrivance of a spectacle lens in order to draw up an appropriately minatory denunciation of the critics of the old order.

Nothing could be less like the Greek environment. Nothing could be more detestable and hampering from the point of view of Modern Science. Yet the question may be seriously raised whether this mediaeval limitation of liberty has not been of *some* value to Science. That it has done much harm, more harm than good, we are all of us of course quite satisfied, but the point I want to raise with you is that there are in fact certain elements in our Science which we do, in part at least, owe to this limitation.

✓ The trouble about Greek Science—excepting always its mathematical work—is the intolerable amount of reckless speculation of a philosophical or semi-philosophical character that it contains, or rather that contains it. The Greek was always seeking to introduce general laws rather than actual instances, and the greatest of the schoolmen, Albertus Magnus, taking his parable from them and becoming more Greek than the Greeks, gravely assures us that *scientia* concerns herself only with universals, not particulars. Science, as we know it to-day, could never flourish under such a theory.

The *scientia* of Albertus was in fact not the Science that we know but the Queen of Sciences, Theology, whose aim and end was foreknown and whose advocates had only to busy themselves with the formal proof and demonstration thereof. But the mediaeval limitation of the region of speculation, which has extended for some purposes right into our own time, by keeping the man of Science to his own task and deflecting him from Philosophy has perhaps had its share in building up an effective apparatus for research.

Growing out of this and on the bad side, however, has been the corresponding tendency to scientific specialization, by which workers in one department lose touch with workers in another. It is, I believe, this tendency to lose contact with each other and with general ideas, and not any innate and essential wickedness in non-scientific humanity, that has prevented Science from obtaining her rightful share in the government of the State and the education of youth. I do not here refer to what may be called natural specialization, the specialization inherent in the human mind, which does in fact turn men toward mathematical methods or biological observation or physical experimentation. Specialization of this kind was as pronounced with the Greeks as it is with us. It was and is necessary—a sign of health and growth. But with us there is another type of specialism derived, as it seems to me, from the mediaeval divorce of Philosophy from Experience, which has been fostered by those institutions, the Universities, that took their characteristic form in the Middle Ages. This specialism is based not on the type of knowledge, nor even on the means of acquiring it, but rather on the area of knowledge to be studied.

As education is becoming more largely scientific, both



these restraints will perhaps be removed. Scientific education will ally itself with Philosophy and take interest in wider generalization. Further, as Science becomes the basis of education, the Science taught will itself need to be more general in character, and will of its nature link together the specialists in the various departments. In the return of Science to its old allegiance to Philosophy, and in the greater generalization of Science teaching we are likely to retrace our steps toward the Greeks. Let us hope that it will not be to enter again on the path of fruitless and baseless speculation which proved their bane.

But there is another characteristic of Ancient Science on which we may profitably dwell. If we examine any Greek work of Science, other than mathematical, we shall perceive certain very striking differences in technical treatment as compared with a modern work. These differences have often been obscured by the panegyrics of those who are more interested in demonstrating the brilliance of the Greek results than in analysing the Greek method. Yet many have felt it difficult to understand, why, with all their brilliance, the Greeks did not carry their physical investigations further than they did. These difficulties are in part at least explained when we examine closely the Greek method of recording results.

Now, omitting always the mathematical works, Greek scientific treatises may be divided into two classes which show a perpetual tendency to overlap. First there are works like Aristotle's *De Generatione et Corruptione* or his *Meteorica* which seek to set out a general theory of the Universe. These are not profoundly based on observation and are mainly made up of ratiocination. If written to-day they would be placed by a modern



librarian under some such heading as 'Philosophy of Science' or 'Scientific Theory' rather than in the class of Science proper. These works serve to emphasize once again the close relation of Greek Science with Philosophy and to demonstrate the temperamental distaste of the Greek mind for the separation of a part of the Universe to be considered in and by itself.

But there is a second group of Greek scientific writings, consisting mainly of biological works, which exhibit another aspect. This group is best illustrated by such works as Aristotle's *History of Animals* or his *Generation of Animals*. These works contain a host of valuable observations that is still not exhausted. From time to time recent observations made by naturalists are found on due investigation to have been anticipated by the Greek philosopher.

But why should such constant re-investigation be necessary? Why cannot we take one of these great biological works of Aristotle as a whole and either verify or reject his conclusions? Why should these justifications of his powers as a naturalist turn up only from time to time? Many competent scholars and men of Science have examined and commented on the Aristotelian writings. Why have none of them thoroughly re-investigated the field of Aristotle's Biology once and for all, and then drawn up for us a clear statement of where he can and where he cannot be safely trusted?

The answer to these questions lies in the nature of the Greek scientific method, and that answer contains, to my mind, the second main distinction between Ancient Science and Modern Science and the ultimate explanation of the failure and bankruptcy of the ancient system.

It is sometimes said that Greek Science failed because

it was without instrumental aids and thus could not reach the degree of precision attained by Modern Science. But this answer does but beg the question and gives a very partial view of the difference between the two systems. The whole question is *why* had they no instruments of precision? Instruments of precision, like the observations made with their aid, are themselves a product of the scientific method, and the point in discussion is why that scientific method failed in one case and succeeded in the other. We shall, therefore, perhaps get a clearer answer if we apply the scientific method itself to the subject of our discussion and turn from discourse concerning the nature and history of Ancient and of Modern Science to actual observations upon the systems. Let us therefore consider examples of the two methods concretely.

Now recent Science has developed a characteristic mode of expression in the so-called *Journal*, a periodical issue of memoirs on special and very narrow problems. Such articles or memoirs have a characteristic and almost constant structure which we may briefly examine: The author of the memoir having stated his problem reviews the efforts made by others to solve it. He points out their errors or he decides to accept their work and to base his own upon it. Perhaps he distrusts their experiments or would like to reinterpret their results. Having surveyed their labours he proceeds to detail his own experiments and observations. Finally, he gives us his deductions from these.

But he is not able to tell us of all his experiments and observations. If he did, scientific literature would be even more bulky than it already is and Science would quickly perish, suffocated under the dead weight of its own verbosity. Our author, in fact, omits a great many



of his mental processes. ✓ He tells us nothing of how he embarked on many different lines of work and abandoned them as unprofitable or too difficult. He tells us nothing of the months or years spent in merely repeating the experience of others. He says not a word of how he acquired and improved his experimental skill and technical experience. He tells merely of the final line of work that has yielded him results. But he does not tell us all even of that. When he had after many trials at last discerned an apparently profitable and feasible direction for his investigations, he reached after a time those conclusions which his final line of work has verified and rendered more exact. It is this final process of verification that he mainly describes in his article, and it is the details of this that occupy the bulk, perhaps nineteen-twentieths or more, of all that he has to say. Then having described these verificatory experiments, he summarizes his conclusions in a short paragraph of a few lines.

Now, how do the scientific works of antiquity compare with material such as this? The corpus of ancient science is of course less in quantity and often fragmentary in character, but it is not that which makes comparison difficult. The difficulty arises from the habit of the Greek writers of setting down only their conclusions. ✓ Their methods of work, even the verificatory observations and experiments, they have almost completely hidden from us, and those methods were almost as completely hidden from their more immediate successors. It is as though we had a collection of the last few lines of a series of scientific articles. To grasp the actual nature of modern scientific method from a scientific article is difficult enough, since not all the mental processes involved are represented. In the case

✓ of Greek Science the difficulty is far greater, for here we have only the conclusions with hardly any or with none of the processes.

In almost all I have said as to the contrast between Greek and Modern Science, Mathematics have been excluded, and for this there is a special reason. The defective Greek scientific method of recording only results is practicably inapplicable to Mathematics. Mathematical results without mathematical processes would be a meaningless inanity. Ancient Mathematics, like everything else that has come down to us from antiquity, have of course suffered from the accidents of time, but the obscuring power of time is a mere light veil compared to that heavy impenetrable curtain that the Greeks have themselves drawn over their biological works.

Thus it comes about that we can form a clear and consecutive picture of the nature and progress of Greek Mathematics. But a corollary to the completeness of this mathematical record is a peculiar phenomenon in the History of Mathematics shared by no other Science. It is that for Mathematics there are no Middle Ages. This does not mean that there was no period when the mathematical knowledge of Europe was backward or arrested or that progress was not at times slow. It is of course true that those disturbances, political and economic, religious and philosophical, that followed the break up of the Roman Empire and destroyed the intellectual life of antiquity, destroyed equally mathematical progress and mathematical thought. But the reason why we can say that there were no Middle Ages for Mathematics is this, that when and where civilization became settled and when and where the Greek record became accessible, then and there it was possible



for the work to be taken up just where the Greeks had left it. ✓ Thus Hindu and Arabic mathematical work is vital and real and valuable and has not those stigmata of degeneration to which the historian of Science is so well accustomed in the Biology and Medicine of Indian or Arabian origin. So the story of Mathematics can be told as one continuous progress from early Greek times to our own day. It is true that the scene changes from continent to continent. It is true that progress is sometimes so slow as to be almost inappreciable. But the progress is there and is continuous, and the historian of Mathematics is able to tell his story as a continuous development of human thought.

It is of course another question altogether as to whether his task as historian is then complete. It is another question whether he should not rather aim at an account of the mathematical powers, aspirations, and achievements of the human mind as a whole throughout the ages. But the point is that it is *possible* for him to tell his story as one continuous progress. This is a privilege denied to the historian of Medicine or of Biology. Why? ✓ Because at many stages the basis of progress, the knowledge of method of investigation, has been concealed and sometimes wantonly concealed.

One of the causes why Chemistry was so long arrested was the desire of the alchemist to conceal his knowledge. His motives were selfish, personal enrichment or glorification by the discovery of the quintessence or of the philosopher's stone. His methods were secret and therefore his manuscripts are among the most obscure and difficult with which the historian of Science ever has to deal. But the alchemist omits his processes by choice, the Greek on principle, on the principle that it is the general conclusions that matter and that the processes

are but means to them. The historian of Science knows better. It is precisely the processes that he seeks. He knows that the conclusions are but a temporal and local accident.

It has been said that the measure of advance of a Science is the degree to which its conclusions are susceptible of expression in mathematical form. But there is another and perhaps a deeper and more constant sense in which all Sciences must borrow from mathematical method. It is in the record of processes. Of nothing is it more true than of Science that the dead govern the living. By the amount to which our processes are clearly and succinctly recorded, by so much do we ensure the permanence of our work, by so much can we guarantee that our successors can begin where we leave off.

This truth can even be applied to the History of Science which is itself, as I would plead to you, an independent Science. By the degree to which we give our references and document our material, by the care with which we edit our manuscripts and index our investigations, by that degree will posterity be grateful to us.

It is, therefore, I submit to you, the distinctive hope and glory of the Science of our age—and I would here use the word Science in its widest sense—that it will place in the hands of the inheritors of our civilization and our thought, whoever they may be, an instrument that will enable them to carry on our work, without halt or pause, from the point at which we leave it.











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